Feb. 17, 1953 S. F. SICILIANO 2,628,641

WEFT DETECTOR FOR LOOMS

Filed Oct. 24, 1951 2 SHEETS—SHEET 1

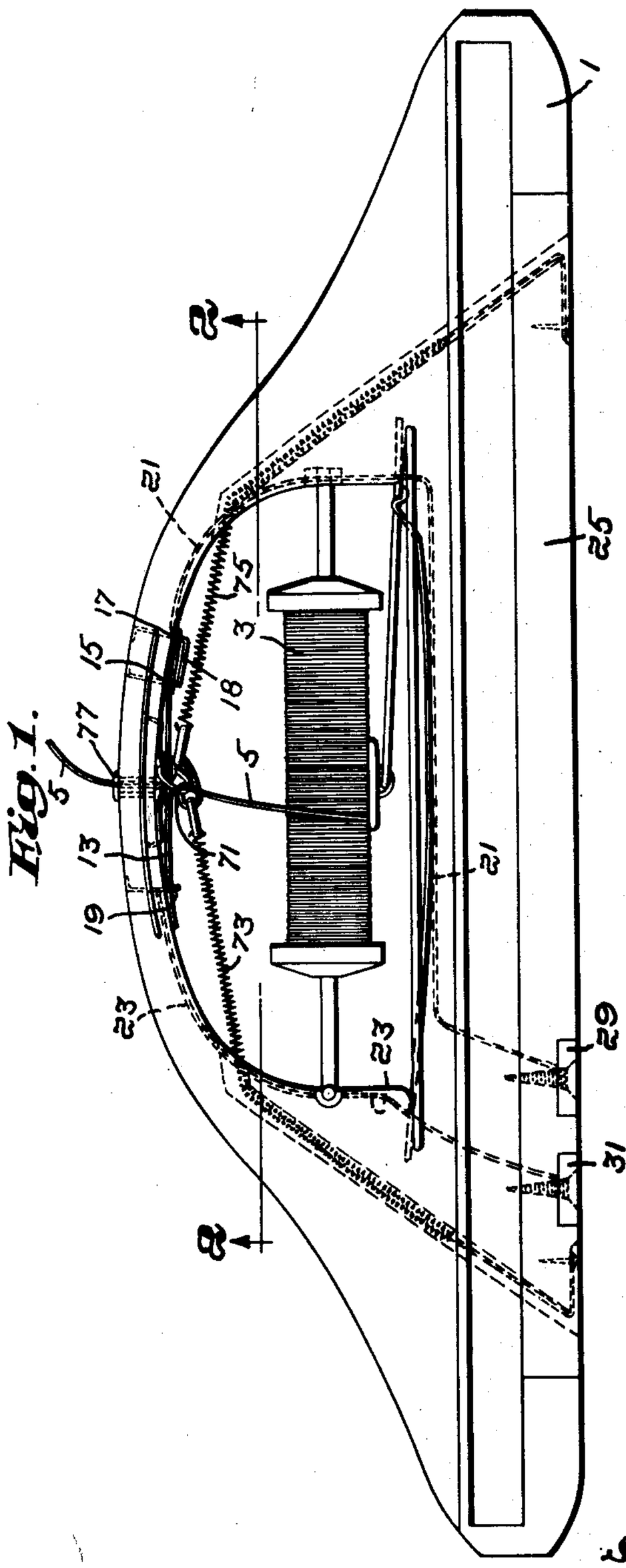

Fig. 1.

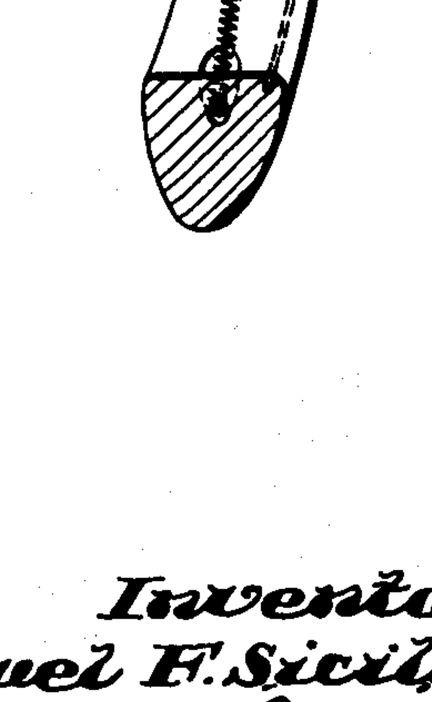

Fig. 2.

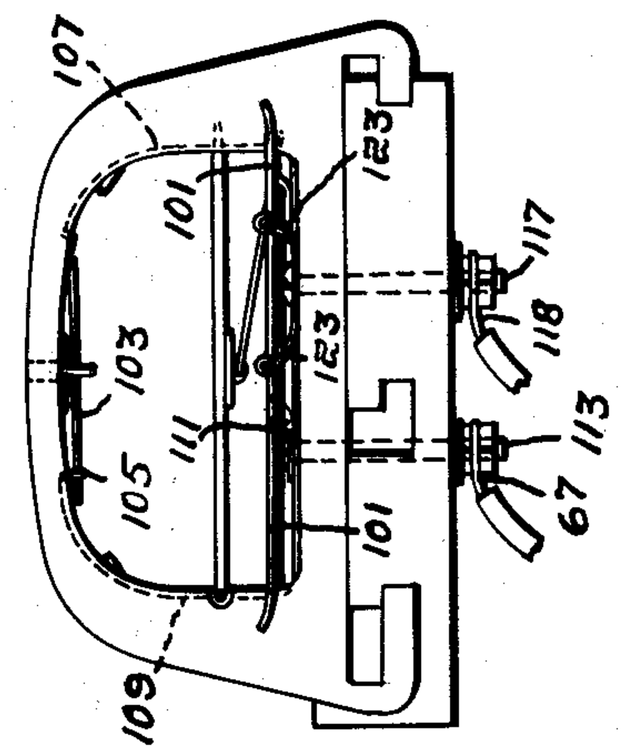

Fig. 6.

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Fig. 3.

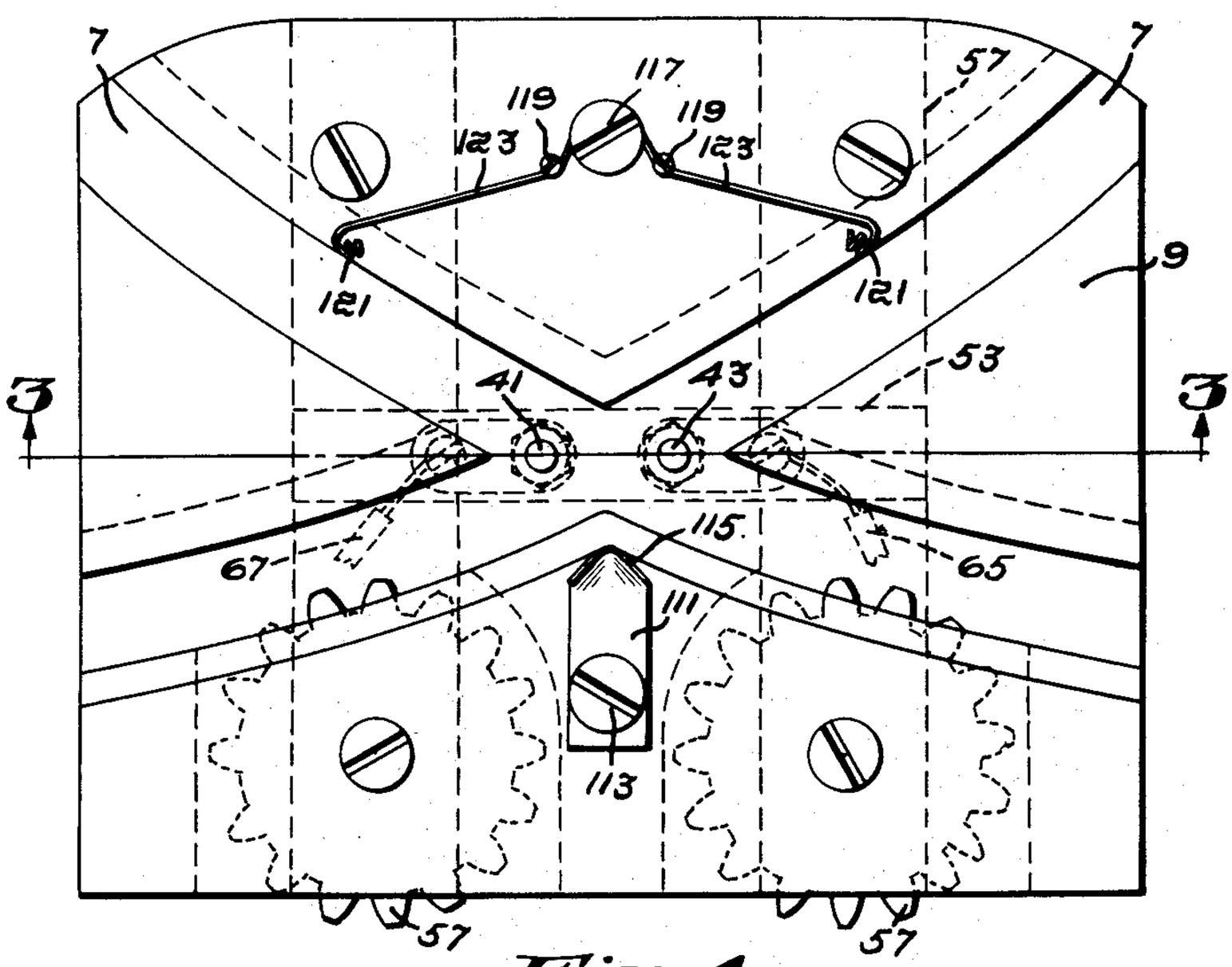


Fig. 4.

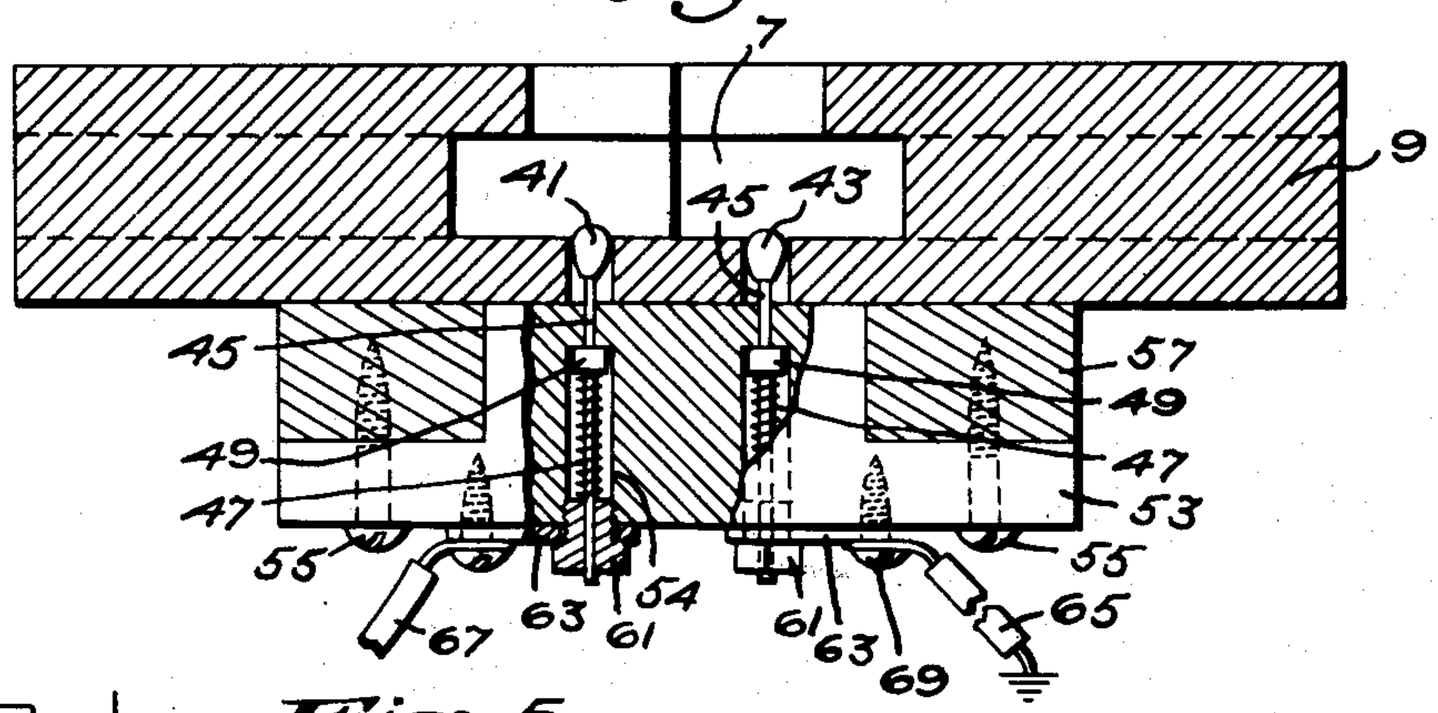
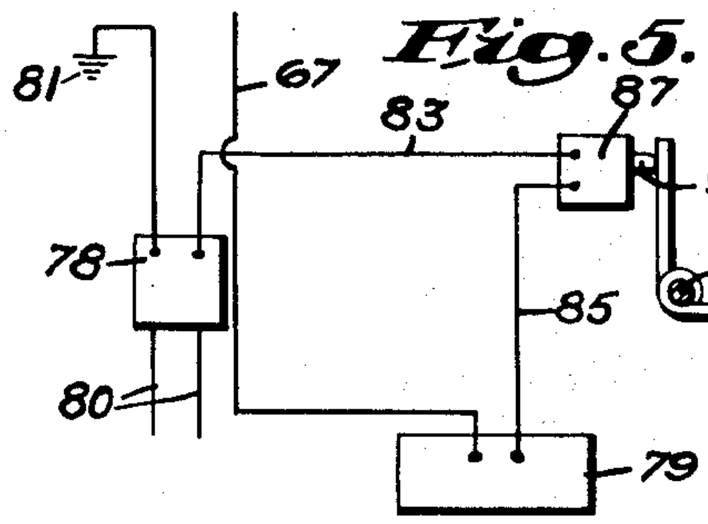


Fig. 5.



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UNITED STATES PATENT OFFICE

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WEFT DETECTOR FOR LOOMS

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15 Claims. (Cl. 139—371)

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This invention relates to devices in the nature of weft detectors particularly for use in narrow fabric looms employing a plurality of reeds and shuttles on the same lay beam to weave a number of distinct fabrics simultaneously.

It is the object of the present invention to provide a mechanism which will instantly detect any failure in the weft supply to any one of the plurality of fabrics woven, whether such failure is caused by breakage or exhaustion of such weft or comprises slackness in the length of weft extending from the fabric to the shuttle during the beat-up and resulting from the failure of the shuttle tension or other causes, and will respond to such detection by immediately stopping the loom. In fulfilling such object the main purpose of this invention is to avoid the drawbacks, even when applied to existing looms, of such structure adding appreciably to the weight of the lay, or cluttering it up with detecting or motion-transmitting elements or other apparatus obstructing the weaver's hands or fingers when working on the loom as in changing bobbins, or tending to catch and tangle with the yarns from spare bobbins placed on the breast beam.

It is thus the aim of this invention to provide a structure which will stop the loom with certainty upon failure of the weft or of its tension devices, while creating no hindrances which will impede or hamper the operator when working on the loom.

Another aim of the invention is to provide a simple means to confine the detecting function to the period in the loom's cycle in which the weft should be in the proper position to be detected.

I have discovered that the object of this invention can be attained by applying a novel filling detector of electrical circuit-making type to the shuttle itself, and providing contacts on the lay or parts thereof for engagement by the terminals of such detector, and suitable leads for carrying a detecting impulse from such detector to external apparatus to actuate a knock-off or loom stop-motion. Such structure thereby avoids all projecting or obstructing additions to the reed, lay, breast beam, or other nearby parts, leaving ample room for the operator to work on the loom.

Other aims of the invention and the manner of their attainment are set forth in the following description.

Illustrative embodiments of the invention are shown in the accompanying drawings, in which

Fig. 1 is a side elevation of the concave side of a bow shuttle of a narrow fabric loom, showing the novel filling detector applied thereto and the filling under proper tension.

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Fig. 2 is a section on line 2—2 of Fig. 1.

Fig. 3 is a front elevation of one shuttle block of a narrow fabric loom, showing means cooperating with the filling detector of the shuttle of Figs. 1 and 6 to receive and transmit an impulse from the detector.

Fig. 4 is a section on line 3—3 of Fig. 3.

Fig. 5 is a diagram of the timing and stop-motion-controlling circuit.

Fig. 6 shows in oblique elevation a shuttle block with a different type of bow shuttle, with the novel filling detector installed in the latter.

The invention is shown as used in connection with a narrow fabric loom employing bow shuttles, though it is equally applicable to straight shuttle narrow fabric looms. Since the shuttle, shuttle block and weft detector shown herein are duplicated and identical at each of the plurality of locations in the length of the lay where the respective fabrics are being woven, only the parts involved in the invention at one such location are shown and described herein.

As usual in many instances, the wooden bow shuttle 1 carrying a bobbin 3 on which is wound the weft or filling 5 travels in a curved path guided by part-circular slots as seen in Fig. 3 forming a shuttle race 7 in the shuttle blocks 9.

In accordance with the invention, the shuttle 1 is equipped with a novel filling feeler 13, Figs. 1 and 2, preferably made of a length of light steel or bronze spring wire, bent at one end in the manner of a coil spring into a pair of double-turn loops 15, 17, through each of which is passed one leg of a staple 18 which fixes the feeler on the under side of the arch or bow of the shuttle. The straight end of feeler 13 is confined loosely within a wire staple 19 fixed in the under side of the arch, the spring feeler being self-biased so that it makes contact with one leg of staple 19 unless prevented from so doing, but presses upward against the under side of the arch and thus is always out of contact with the cross-bar of the staple 19. The spring feeler 13 and its contact comprised by wire staple 19 are connected respectively to wires 21 and 23 imbedded in cement in grooves cut in the shuttle and leading around the bobbin chamber to terminals 29 and 31, in the base of the shuttle comprising metallic contact plates (preferably of copper or silver) mounted flush on the under side of the shuttle runner 25. These contacts 29, 31, on the shuttle runner make contact respectively with spring-pressed metallic plungers 41, 43, located at the intersection of the two shuttle races 7 in each shuttle block 9. These plungers comprise rounded metallic heads fixed on shanks 45 and impelled

inward into shuttle races 7 by expanding springs 47 bearing against shoulders 49 on the shanks, the plungers working in sockets 54 formed in a block of fiber 53 fixed by screws 55 to the vertical cleats 57 present on the back of shuttle block 9. Metallic bushings 61 guide the outward ends of the plunger shanks and confine the springs 47, these bushings being threaded into the outer end of sockets 54 and passing through metallic lugs 63 to which are attached by screws 69 a pair of wires 65, 67, controlling the action of an electrical knock-off or loom stop motion of standard type.

As the successful action of the feeler is based on the fact that the filling 5 is in proper condition for continued weaving if, at the end of each pick, it extends in tight relation from the selvage of the fabric to the shuttle eye, the metallic contact plates 29, 31, are so disposed in the length of the shuttle runner 25 that they will make contact with their respective plungers 41, 43, when the shuttle is at rest at the left-hand side of its fabric. At this moment the feeler 13 is held out of contact with staple 19 by the taut and unbroken condition of the filling 5 which in threading the shuttle is led from the bobbin through the usual guide 71, then through the eye in the end of each of the usual shuttle tension springs 73 and 75, past the feeler wire 13 on the side thereof toward which the feeler is urged by its coil 15, and through the shuttle eye 77 to the fell of the cloth.

Since the feeler 13 is so sensitive that a slackening of the filling even for a small fraction of an inch allows the feeler to close the circuit and actuate the loom stop motion, I use a timing mechanism such as that shown in my prior U. S. Patent No. 2,470,527, and set it to open the stop motion controlling circuit for most of the loom's cycle but to close the circuit by cam action for just an instant as the shuttle approaches or dwells at its highest point at the left of the fabric, contacts 29, 31 and 41, 43 being then in mutual engagement. Thus, if the filling is in good working condition and properly tensioned as regards its unbroken extent from the fell to the shuttle the filling feeler will be held out of contact with its staple 19 and the circuit held open even though the shuttle has reached the dwell point on the shuttle race and the cam action has closed the remainder of the control circuit. But if the filling is broken, or has run out, or is too slack, it will fail to hold the feeler from contact with staple 19 and thus the circuit is completed and calls a change in the manner of operation of the loom, herein by actuating the loom stop motion.

This mechanism of my prior patent is illustrated in Fig. 5. It comprises an electrical circuit supplied with 12-volt current from the low voltage side of a step-down transformer 78 fed by mains 80, one terminal of the low voltage side being grounded on the machine frame at 81. Low voltage current from the other terminal is carried to the stop motion 79 by leads 83, 85, and thence to plunger 41 via lead 67, passing through the shuttle circuit, in case feeler 13 so permits, to plunger 43 and thence to ground via lead 65. Passage of the current through leads 83, 85 is additionally controlled by a switch 87 which is actuated mechanically in timed relation to the loom's cycle in such manner that the current can pass such switch and thus flow through the circuit only as the lay arrives at front center to effect the beating up of the pick which has been laid in from right to left of the cloth.

The timing switch 87, which thus limits the response of the circuit including the loom stop motion 79 to the brief period during which the shuttle approaches or dwells at its highest point, is actuated from any suitable or preferred part on the loom, herein by means of a cam 89 fixed on the loom cam shaft 91, making one rotation for every two beats of the lay. Thus the rise of cam 89 rocks a bell-crank lever 93 counterclockwise about a pivot 95, suitably mounted on a fixed part of the loom, such lever pushing in the spring plunger 97 to close such switch momentarily, each time the lay reaches front center with the shuttle 1 standing at the left side of the fabric being woven thereby.

As is obvious, it is only when the circuit is closed simultaneously by the filling feeler 13 and the switch 87 that it actuates the stop motion 79 to stop the loom, and this can only occur when slackness or failure of the filling permits feeler 13 to reach its contact, staple 19.

Fig. 6 shows another embodiment of my invention using the same feeler applied to another standard form of narrow fabric shuttle, wherein, instead of using metal plates in one underside of the shuttle to transmit the detecting impulse from the weft feeler to the loom stop motion, I connect the usual pair of heavy spring wires 101 called shuttle bridges to the weft-feeler 103 and its wire staple contact 105 by leads 107, 109 respectively. These bridges 101 extend outward from the base of the shuttle and along each side of the shuttle. On each shuttle block 9 there is provided just below the crossing point of the two shuttle races 7 a contact 111 of resilient sheet metal fixed to the block by bolt 113 and having its upper corners 115 bent upward so that the shuttle bridge 101 on the convex side of the shuttle will engage, lift, and slide along under such contact 111 as a shuttle crosses the intersection of shuttle races 7 from either side of the shuttle block. A second contact member is provided just above the intersection, in the form of a spring wire looped under the head of a retaining bolt 117 and coiled around small screws 119 set in the block 9. The upturned free extremities 121 of its two lateral branches 123 are located so as to intercept and slide along in contact with the shuttle bridge 101 at the concave side of the shuttle. This contact is made by the right-hand branch 123 when the shuttle enters the block from the left, and with the left-hand branch when the shuttle enters from the right. At each of the plurality of shuttle blocks 9 across the width of the loom this contact member is grounded on the loom frame by suitably connecting its retaining bolt 117 to the lay back, as by wire 118. The other contact 111 of each shuttle block is connected by a common lead run along the back of the lay to wire 67 of the diagram of Fig. 5, just as in the case of the first embodiment, and thus the device acts to stop the loom whenever simultaneous closure of the circuit by feeler 103 and switch 87 occurs.

In the form of Fig. 6, by providing cam 89 of Fig. 5 with two risers 180° apart so as to close switch 87 at each beat of the lay, testing of the condition of the filling is performed after each pick instead of after each two picks as in the form of Fig. 1. This is because the same contact is made between shuttle bridges 101 and contacts 111, 123, when the shuttle enters block 9 from either side. Double protection against any weft defect is thus afforded in this form of Fig. 6. The loom will be stopped immediately following any pick on which feeler 103 fails to be held out

of contact with its staple 105. The parts required for the invention in no way hamper or impede the work of the weaver. It will be understood that contacts 111, 123 are not used on the same shuttle block as plungers 41, 43, but are alternative forms for use with the shuttle of Fig. 6 only.

While I have illustrated and described certain forms in which the invention may be embodied, I am aware that many modifications may be made therein by any person skilled in the art, without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to the particular forms shown, or to the details of construction thereof, but

What I do claim is:

1. In a narrow fabric loom having a stop motion, in combination, a bow shuttle, weft tensioning means and a delivery eye and a guide on the shuttle, an electrical contact on the shuttle periodically grounded on the loom frame, and a contact maker held out of engagement with the contact so long as the weft maintains a predetermined degree of tension in its extent between the delivery eye and the guide, the contact maker energizing the stop motion when it engages the contact while such electrical contact is grounded on the loom frame.

2. In a narrow fabric loom having a stop motion, in combination, a bow shuttle, weft tensioning means and a delivery eye and a guide on the shuttle, an electric circuit for actuating the stop motion, and a weft feeler on the shuttle periodically entering into the circuit and held from action by the weft thread so long as the weft maintains a predetermined degree of tension in its extent between the delivery eye and the guide, such feeler closing the circuit and actuating the loom stop motion when the tension falls below the predetermined degree.

3. In a narrow fabric having a stop motion, in combination, a bow shuttle, weft tensioning means and a delivery eye and a guide on the shuttle, an electric circuit for actuating the stop motion, and a weft feeler on the shuttle periodically entering into the circuit and responding to reduction in the tension of the weft between the delivery eye and the guide by closing the circuit and actuating the stop motion.

4. In a narrow fabric loom having a stop motion, in combination, a bow shuttle, weft tensioning means on the shuttle, an electric circuit for actuating the stop motion, and a weft feeler on the shuttle and in the circuit and responding to slackening of the weft's tension within the shuttle by closing the circuit and thus actuating the stop motion.

5. In a narrow fabric loom having a stop motion, in combination, a bow shuttle having weft tensioning means, a weft feeler mounted inside the shuttle, an electric circuit for actuating the stop motion, and a contact periodically grounded on the loom frame, the feeler engaging the contact to close the circuit and actuate the loom stop motion when the feeler detects a slack weft as the contact is grounded to the loom frame.

6. In a narrow fabric loom having a stop motion, in combination, a bow shuttle, weft tensioning means on the shuttle, a weft feeler mounted on the shuttle, an electric circuit for actuating the stop motion, and electrical conducting plates fixed on the shuttle base closing the electric circuit from the weft feeler to the stop motion when the feeler detects a slack weft.

7. In a narrow fabric loom having a stop motion, in combination, a bow shuttle, a delivery eye and guide therein, an electric circuit actuating the stop motion, a weft feeler on the shuttle acting to close the circuit when the tension in the weft in its extent between the delivery eye and the guide falls below a predetermined amount, and means opening the electric circuit at another point when the shuttle is at other positions than at the end of a pick.

8. In a narrow fabric loom having a stop motion, in combination, a bow shuttle, weft tensioning means and a delivery eye and a guide on the shuttle, an electric circuit actuating the stop motion, a contact element in such circuit, and a weft feeler on the shuttle making contact with the contact element to close the circuit but periodically held withdrawn from such contact by the weft extending between the delivery eye and the guide so long as the weft remains in proper working condition.

9. In a narrow fabric loom having a stop motion and a bow shuttle, in combination, an electric circuit actuating the stop motion when closed, means opening such circuit at one point at all times except when the shuttle is at rest, a yarn bobbin and a delivery eye in the shuttle, and a circuit closer in the shuttle held open by the tension in the extent of yarn reaching from the bobbin to the delivery eye but acting to close the electric circuit actuating the stop motion at a different point when such tension falls below a predetermined degree.

10. In a narrow fabric loom having a stop motion and a shuttle block, in combination, a bow shuttle, a weft bobbin, a delivery eye on the shuttle, an electric circuit actuating the stop motion and having terminals on the shuttle block, contacts mounted on the shuttle engaging such terminals, and a weft feeler acting to close the circuit through the contacts to actuate the stop motion when the weft in the extent between the delivery eye and bobbin fails to maintain a predetermined tension while the shuttle is at rest.

11. In a narrow fabric loom having a stop motion, in combination, a shuttle block, a bow shuttle, shuttle bridges on the shuttle, a weft carrier, contacts mounted on the shuttle block and engaging such bridges, a delivery eye and guide on the shuttle, an electric circuit actuating the stop motion and terminating in such contacts, and a weft feeler acting to close the circuit through the shuttle bridges when the weft in its extent between the delivery eye and guide fails to maintain a predetermined degree of tension.

12. In a narrow fabric loom having a stop motion, in combination, a shuttle block, a bow shuttle, a weft carrier, a shuttle bridge on each side of the shuttle, an electric circuit actuating the stop motion, contacts on the shuttle block engaging the bridges and forming the terminals of the circuit, and a weft feeler connected electrically to the shuttle bridges actting to close the circuit to call a change in the action of the loom when the weft fails to remain in proper working condition while the shuttle is at rest.

13. In a narrow fabric loom having a stop motion, in combination, a bow shuttle, a shuttle block, shuttle bridges on each side of the shuttle, an electric circuit for actuating the stop motion, spring contacts on the shuttle block forming the terminals of such contact, and a weft feeler on the shuttle closing the circuit through the shuttle bridges, the latter being in wiping contact with the spring contacts on the shuttle block, and actuating the stop motion when the

weft fails to remain in proper working condition while the shuttle is at rest.

14. In a narrow fabric loom having a stop motion, in combination, a bow shuttle having weft tensioning means, an electric circuit for actuating the stop motion, and a shuttle-mounted weft feeler adapted to close the circuit to actuate the stop motion when the weft tension within the shuttle falls below a predetermined degree, and means breaking the electrical circuit except when the shuttle is at rest.

15. In a narrow fabric loom having a stop motion, in combination, a shuttle, a weft supply therein, a shuttle-carried circuit closer governed by the tension of the weft within the shuttle, an electric circuit actuating the stop motion and including the circuit closer, and means interrupting such circuit except while the shuttle is at rest.

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